Industrial Control

(النظرى)

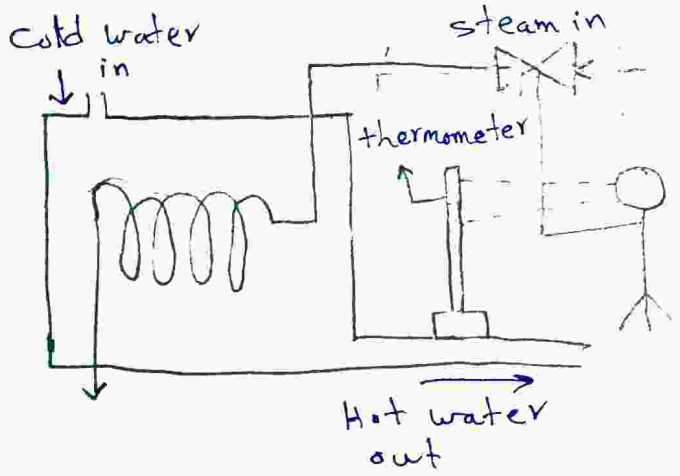
until midterm.

Process Control

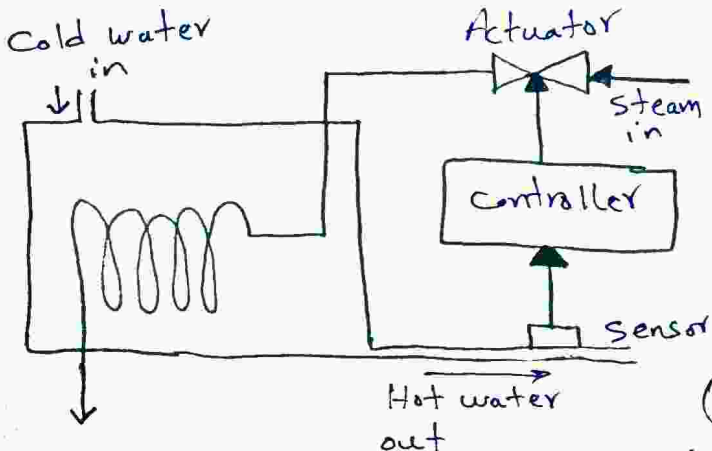
Definition

↳ automatic control of an output variable by sensing the amplitude of output parameter from the process & comparing it to desired or set level and feeding error signal back to control an input variable.

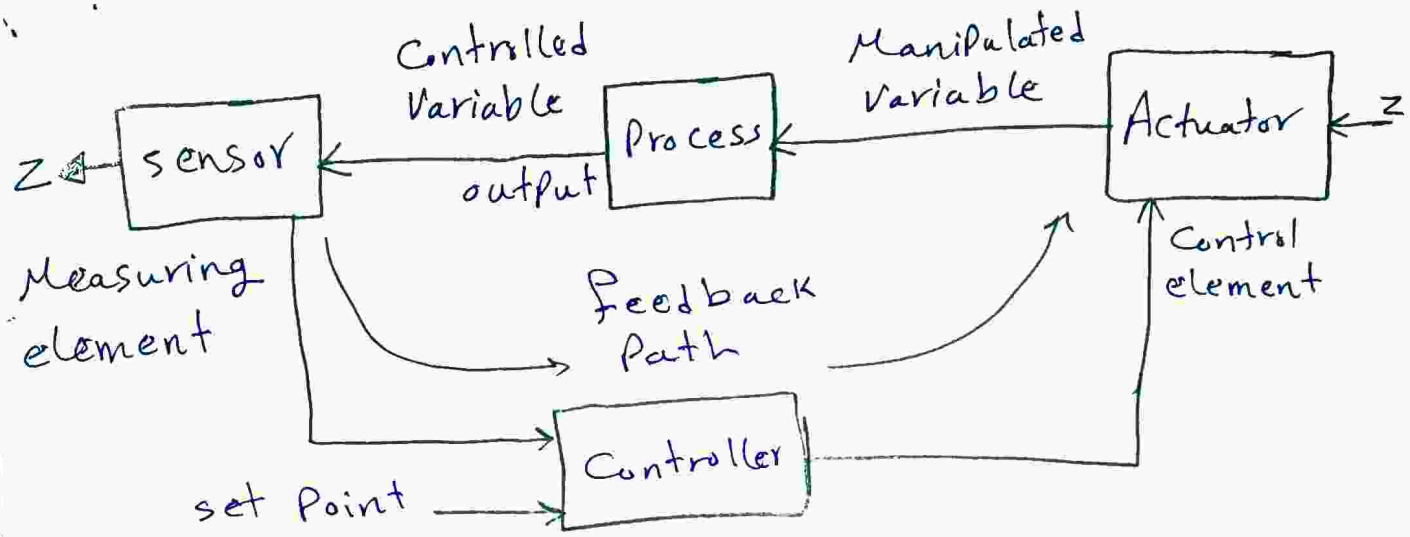
↝ two graphs show manual & automatic control



Manual control



ـه الـ (sensor) هنا بيعمل (sense) للمياه الخارجة (حرارتها زادت أو قلت) لو حصل تغيير في الحرارة هيبعت لـ (controller) اللي بدوره هيبعت لـ (actuator) اللي هيظبط الـ (steam flow) عشان نحصل على درجة الحرارة المطلوبة.



"Block diagram of Process Control loop"

* Controlled Variable vs Manipulated variable

1) Controlled (measured) variable

↳ the monitored output variable from a Process.

↳ The value of monitored output Parameter is normally held within tight given limits.

2) Manipulated variable.

↳ the input variable or Parameter that is varied by a control signal from Processor to an actuator.

↳ by changing the input variable the value of the measured variable can be controlled.

* Set Point
↳ the desired value of the output Parameter or variable being monitored by a sensor.
↳ Any deviation from this value will generate an error signal.

*Feedback loop :-
↳ signal path from output back to the input to correct for any variation between the output level from set level.

* Transducers
↳ devices that can change one form of energy to another.
ex resistance thermometer converts temperature into electrical resistance.

* Converters
↳ devices used to change format of signal without changing energy form.

*Actuator
↳ devices that are used to control an input variable in response to a signal from controller.

* Controllers

↳ devices that monitor signals from transducers and take necessary action to keep Process within specified limits.

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* PLC (Programmable logic Controllers)

↳ used in Process-control applications.

↳ have the ability to use (analog or digital) input info. and output signals.

↳ can Communicate other controllers globally.

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*error signal

↳ difference between set point and amplitude of measured variable

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* Correction signal:

↳ signal used to control power to actuator to set the level of input variable.

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* Transmitters

↳ devices used to amplify and format signals to be suitable for transmission over long distances with minimal loss of information.

Smart Sensors

*Sensor

↳ element that Produces signal relating to the quantity to be measured.

↳ devices that can detect physical variables such that temperature or motion

*Smart sensor

↳ It is the intelligent sensor.

↳ which is termed from combining electrical output (Produced from sensor) with some interfacing hardwares.

* sensors + " " = Smart sensors.

Applications

* General applications:.

1) self calibration 2) Communication

3) Computation. 4) Multi sensing.

* Industrial applications:-

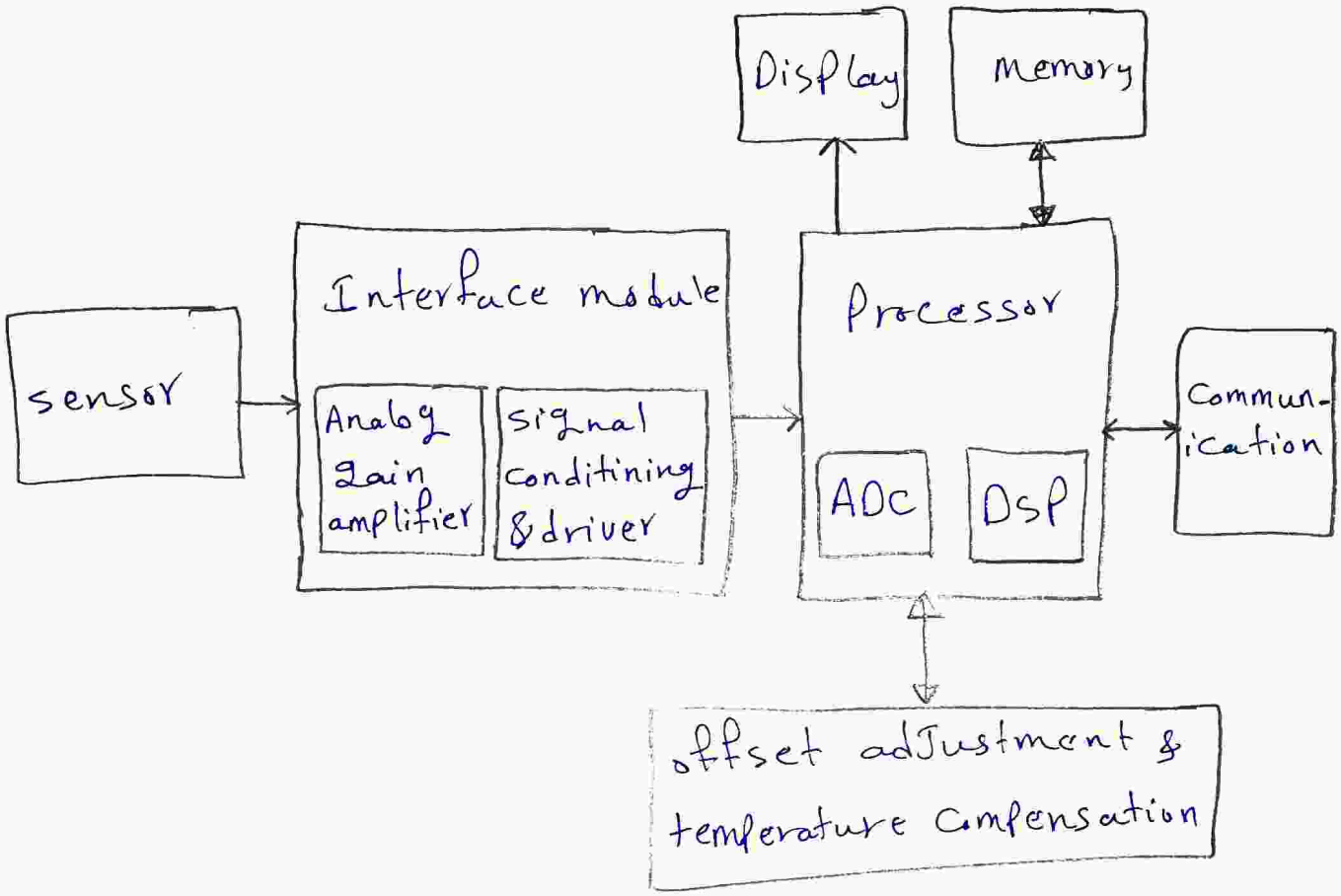
1) optical sensor. 2) Infra red detector.

3) structural monitoring. 4) Gelogical mapping

*Medical apps:

1) Food safety 2) Health monitoring. 3) Medical diagnostics.

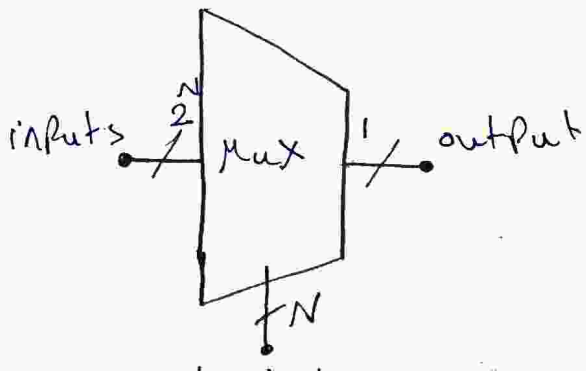
* Block diagram of smart sensor :-



* MultiPlexer (MUX)

↳ device that selects one of several analog or digital input signals and forward the selected input into single line.

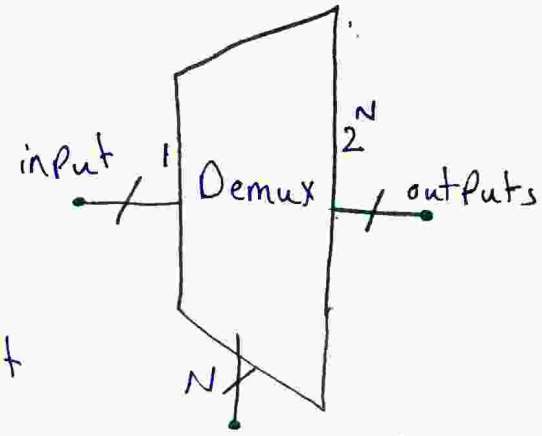
↳ A MUX of 2^n inputs has n select lines, which are used to select which input line to send to output.



* Demutiplexer

↳ device that Produces multiple number of outputs from a single input.

↳ A demux with single input an 2^n outputs has n select lines.



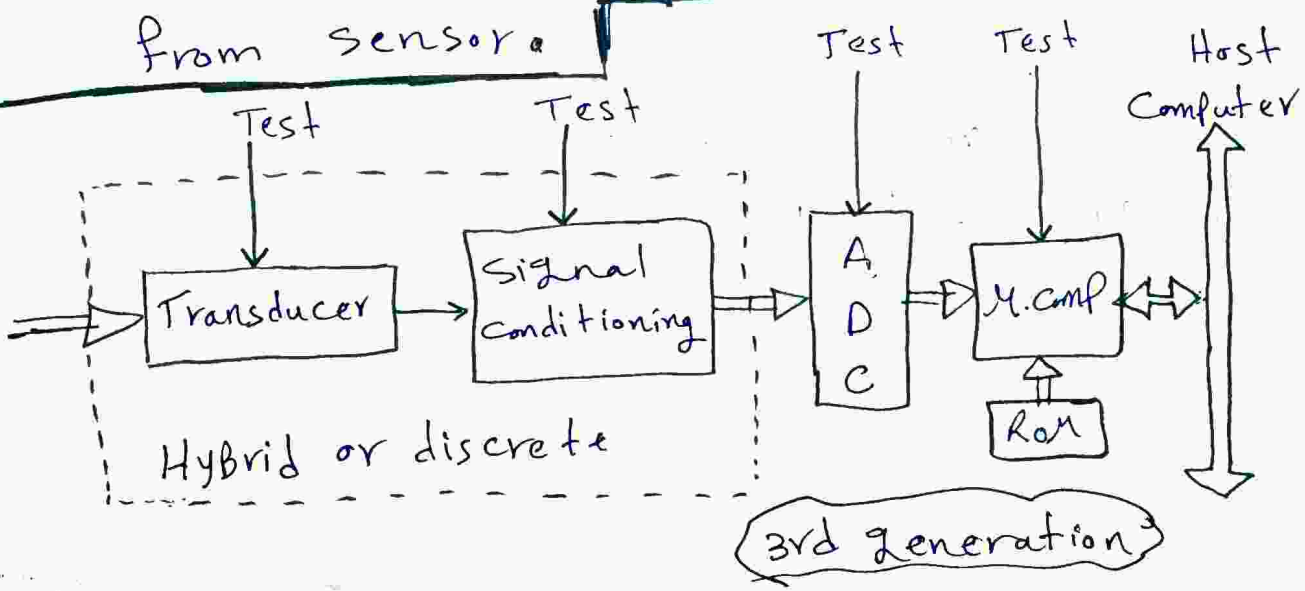
Evolution of smart sensors

* 1st generation:

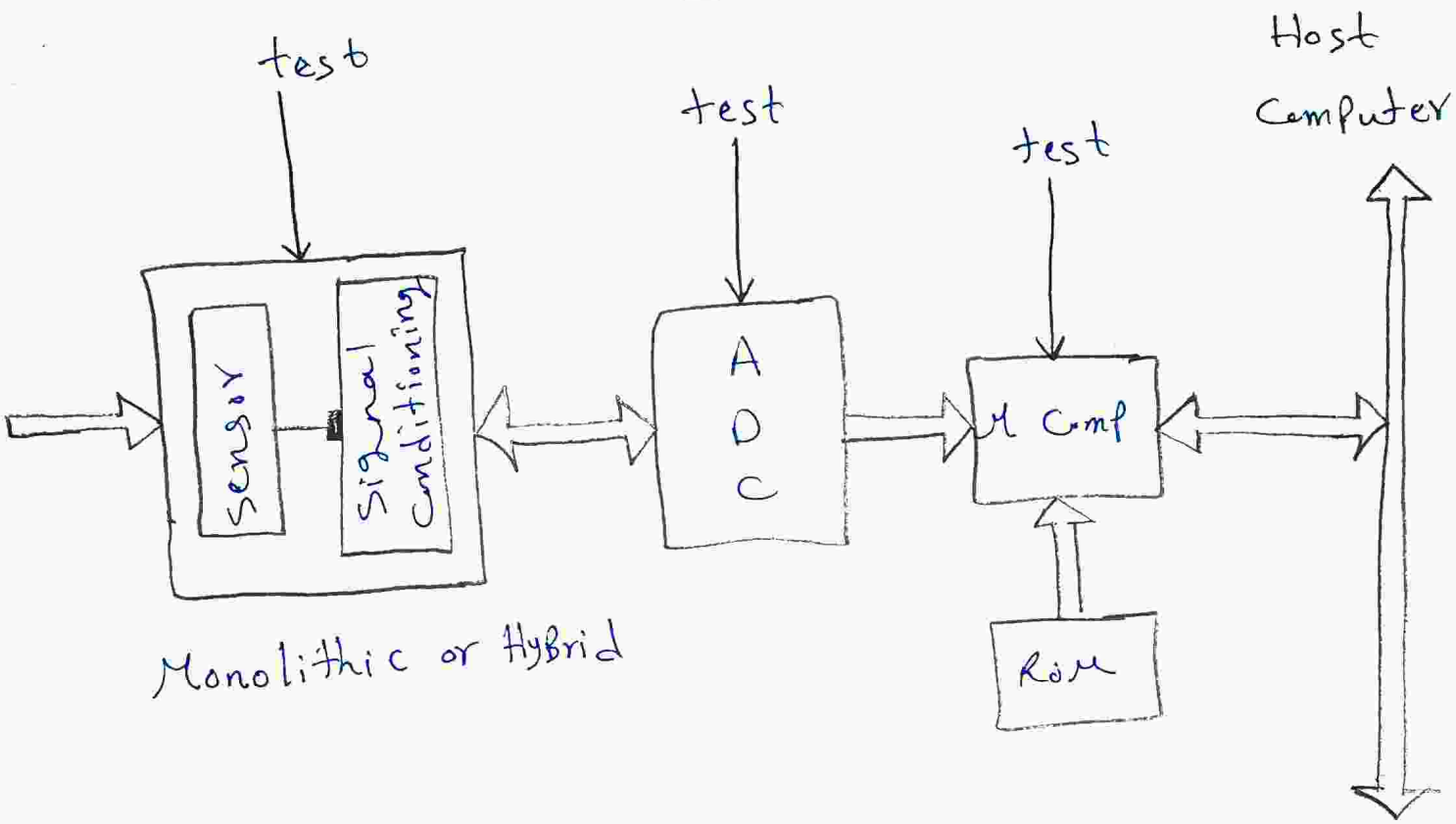
↳ Its devices had little, if any electronics associated with ~~them~~ them.

* 2nd generation sensors

↳ were part of purely analog systems with virtually all of electronics remote from sensor.



Fourth generation



Fifth generation